# Executive Order G-70-153-AD

## Dresser Wayne WayneVac
## Phase II Vapor Recovery System

## Exhibit 3

## STATIC PRESSURE INTEGRITY TEST
## UNDERGROUND STORAGE TANKS

### 1. APPLICABILITY

**1.1** This test procedure is used to quantify the vapor tightness of vapor recovery systems installed at gasoline dispensing facilities (GDF) equipped with vacuum assist systems which require pressure/vacuum (P/V) valves, provided that the designed pressure setting of the P/V valves is a minimum of 2.5 inches of water column (inches $H_2O$). The most current version of TP-201.3 is an acceptable alternative method and will provide the same result. Excessive leaks in the vapor recovery system will increase the quantity of fugitive hydrocarbon emissions and lower the overall efficiencies of both the Phase I and Phase II vapor recovery systems.

**1.2** Systems equipped with a P/V valve(s) allowed to have a designed cracking pressure less than 2.5 inches $H_2O$ shall be bagged to eliminate any flow contribution through the valve assembly from the test results. The valve/vent pipe connection, however, shall remain unobstructed during this test.

### 2. PRINCIPLE

**2.1** The entire vapor recovery system is pressurized with nitrogen to two (2.0) inches $H_2O$. The system pressure is then allowed to decay and the pressure after five (5) minutes is compared with an allowable value. The minimum allowable five-minute final pressure is based on the system ullage and pressure decay equations. For the purpose of compliance determination, this test shall be conducted after all back-filling, paving and installation of all Phase I and Phase II components, including P/V valves, has been completed.

**2.2** For GDF equipped with a coaxial Phase I system, this test shall be conducted at a Phase II vapor riser. For GDF which utilize a two-point Phase I system, this test may be conducted at either a Phase II riser or a Phase I vapor coupler provided that the criteria set forth in Section 6.7 have been met. If the integrity criteria for two-point systems specified in Section 6.7 are met, it is recommended that this test be conducted at the Phase I vapor coupler.

### 3. RANGE

**3.1** If mechanical pressure gauges are employed, the full-scale range of the pressure gauges shall be 0-2.0, 0-1.0, and 0-0.50 inches $H_2O$ column. Maximum incremental graduations of the pressure gauge shall be 0.05 inches $H_2O$ and the minimum accuracy of the gauge shall be three percent of full scale. The minimum diameter of the pressure gauge face shall be 4 inches. A 0-2 inches $H_2O$ inclined manometer, or equivalent, may be used provided that the minor scale divisions do not exceed 0.02 inches $H_2O$.

**3.2** If an electronic pressure measuring device is used, the full-scale range of the device shall not exceed 0-10 inches $H_2O$ with a minimum accuracy of 0.5 percent of full-scale. A 0-20 inches $H_2O$ device may be used, provided the equivalent accuracy is not less than 0.25 percent of full scale.

**3.3** The minimum and maximum total ullages shall be 500 and 25,000 gallons, respectively. These values are exclusive of all vapor piping volumes (See Section 6.3).

**3.4** The minimum and maximum nitrogen feed-rates, into the system, shall be one (1) and five (5) CFM, respectively.

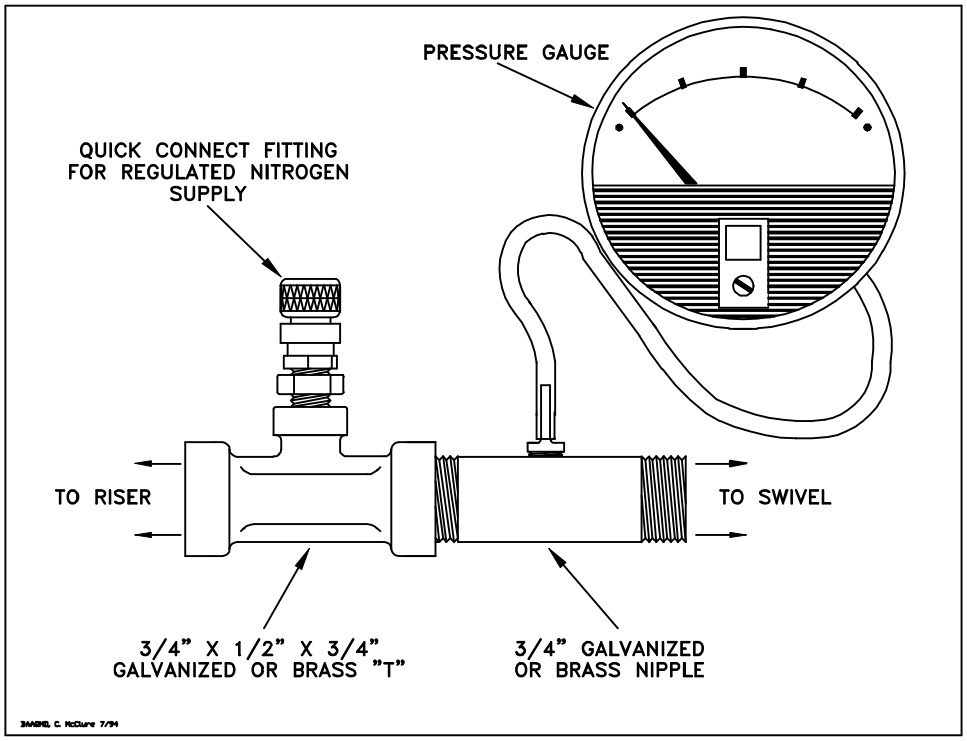
## 4. INTERFERENCES

**4.1** Introduction of nitrogen into the system at flowrates exceeding five (5) CFM may bias the results of the test toward non-compliance. Only gaseous nitrogen shall be used to conduct this test. Air, liquefied nitrogen, helium, or any gas other than nitrogen **shall not be used at any time** for this test procedure.

**4.2** The results of this Static Pressure Integrity Test shall not be used to verify compliance if an Air to Liquid Volumetric Ratio Test (Test Procedure TP-201.5 or equivalent) was conducted within the 24 hours prior to this test.

**Figure 3-1**

**"T" Connector Assembly**



## 5. APPARATUS

**5.1** Nitrogen. Use commercial grade nitrogen in a high pressure cylinder, equipped with a two-stage pressure regulator and a one psig pressure relief valve.

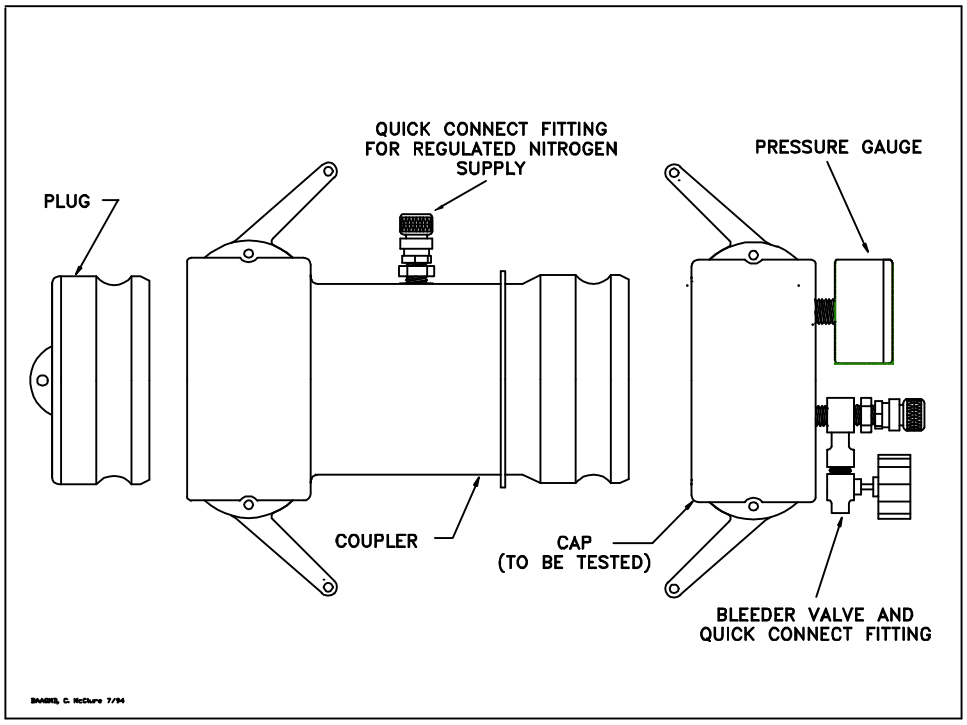
**5.2** Pressure Measuring Device. Use 0-2.0, 0-1.0, and 0-0.50 inches $H_2O$ pressure gauges connected in parallel, a 0-2 inches $H_2O$ manometer, or an electronic pressure measuring device to monitor the pressure decay in the vapor recovery system. The pressure measuring device shall, at a minimum, be readable to the nearest 0.05 inches $H_2O$.

**5.3** "T" Connector Assembly. See Figure 3-1 for example.

**5.4** Vapor Coupler Integrity Assembly. Assemble OPW 633-A, 633-B, and 634-A adapters, or equivalent, as shown in Figure 3-2. If the test is to be conducted at the storage tank Phase I vapor coupler, this assembly shall be used prior to conducting the static leak test in order to verify the pressure integrity of the vapor poppet. The internal volume of this assembly shall not exceed 0.1 cubic feet.

**Figure 3-2**

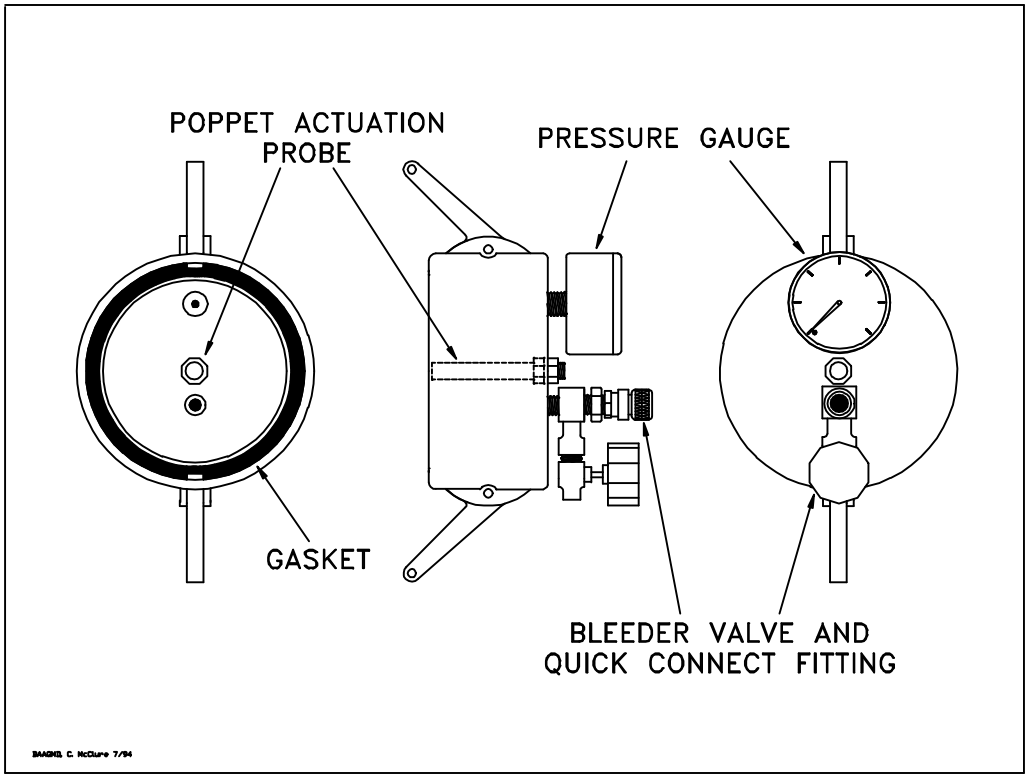
**Vapor Coupler Integrity Assembly**



**5.5** Vapor Coupler Test Assembly. Use a compatible OPW 634-B cap, or equivalent, equipped with a center probe to open the poppet, a pressure measuring device to monitor the pressure decay, and a connection for the introduction of nitrogen into the system. See Figure 3-3 for an example.

**Figure 3-3**

**Vapor Coupler Integrity Assembly**




**5.6** Stopwatch. Use a stopwatch accurate to within 0.2 seconds.

**5.7** Flowmeter. Use a Dwyer flowmeter, Model RMC-104, or equivalent, to determine the required pressure setting of the delivery pressure gauge on the nitrogen supply pressure regulator. This pressure shall be set such that the nitrogen flowrate is between 1.0 and 5.0 CFM.

**5.8** Combustible Gas Detector. A Bacharach Instrument Company, Model 0023-7356, or equivalent, may be used to verify the pressure integrity of system components during this test.

**5.9** Leak Detection Solution. Any liquid solution designed to detect vapor leaks may be used to verify the pressure integrity of system components during this test.

## 6. PRE-TEST PROCEDURES

**6.1** The following safety precautions shall be followed:

**6.1.1** Only nitrogen shall be used to pressurize the system.

**6.1.2** A one psig relief valve shall be installed to prevent the possible over-pressurizing of the storage tank.

**6.1.3** A ground strap should be employed during the introduction of nitrogen into the system.

**6.2** Failure to adhere to any or all of the following time and activity restrictions shall invalidate the test results:

**6.2.1** There shall be no Phase I bulk product deliveries into or out of the storage tank(s) within the three (3) hours prior to the test or during performance of this test procedure.

**6.2.2** There shall be no product dispensing within thirty (30) minutes prior to the test or during performance of this test procedure.

**6.2.3** Upon commencement of the thirty minute “no dispensing” portion of this procedure, the headspace pressure in the tank shall be measured. If the pressure exceeds 0.50 inches $H_2O$, the pressure shall be carefully relieved in accordance with all applicable safety requirements. After the thirty minute “no dispensing” portion of this procedure, and prior to introduction of nitrogen, the headspace pressure shall again be lowered, if necessary, to less than 0.50 inches $H_2O$.

**6.2.4** There shall be no Air to Liquid Volumetric Ratio Test (Test Procedure TP-201.5) conducted within the twenty-four (24) hour period immediately prior to this test.

**6.3** Measure the gallons of gasoline present in each underground storage tank and determine the actual capacity of each storage tank from facility records. Calculate the ullage space for each tank by subtracting the gasoline gallonage present from the actual tank capacity. The minimum ullage during the test, for all manifolded tanks, shall be 1000 gallons or 25 percent of the tank capacity, whichever is less. **The total ullage, for all manifolded tanks, shall not exceed 25,000 gallons**.

**6.4** For two-point Phase I systems, this test shall be conducted with the dust cap removed from the vapor coupler. This is necessary to determine the vapor tightness of the Phase I vapor poppet. See Section 6.7 if this test is to be conducted at the Phase I vapor coupler.

**6.4.1** For coaxial Phase I systems, this test shall be conducted with the dust cap removed from the Phase I coupler. This is necessary to insure the vapor tightness of the Phase I vapor poppet.

**6.4.2** Verify that the liquid level in the storage tank is at least four (4) inches above the highest opening at the bottom of the submerged drop tube.

**6.5** If the Phase I containment box is equipped with a drain valve, the valve assembly may be cleaned and lubricated prior to the test. This test shall, however, be conducted with the drain valve installed and the manhole cover removed. See subsection 7.4.1 for further details regarding containment box drain valves.

**6.6** If the test is to be conducted at a Phase II vapor riser, disconnect the dispenser end of one vapor recovery hose and install the "T" connector assembly (see Figure 3-1). Connect the nitrogen gas supply (do not use air) and the pressure measuring device to the "T" connector.

**6.6.1** For those Phase II systems utilizing a dispenser mounted remote vapor check valve, the “T” connector assembly shall be installed on the vapor riser side of the check valve.

**6.7** If this test is to be conducted at the Phase I vapor coupler on a two-point Phase I system, the procedures set forth in subsections 6.7.1 and 6.7.2 shall be successfully completed prior to testing. The static pressure integrity test shall not be conducted at the Phase I coupler at facilities equipped with coaxial Phase I systems.

**6.7.1** Connect the Vapor Coupler Integrity Assembly to the Phase I vapor coupler. Connect the Vapor Coupler Test Assembly. Connect the nitrogen supply to the assembly and carefully pressurize the internal volume of the assembly to two (2.0) inches $H_2O$. Start the stopwatch. Record the final pressure after one minute.

**6.7.2** If the pressure after one minute is less than 0.25 inches $H_2O$, the leak rate through the Phase I vapor poppet precludes conducting the static leak test at this location. If the pressure after one minute is greater than or equal to 0.25 inches $H_2O$, the static leak test may be conducted at this location. This criteria assures a maximum leak rate through the Phase I vapor poppet of less than 0.0004 cubic feet per minute.

**6.7.3** Disconnect the Vapor Coupler Integrity Assembly from the Phase I vapor coupler. If the requirements of subsection 6.7.2 were met, connect the Vapor Coupler Test Assembly to the Phase I vapor coupler.

**6.7.4** As an alternate to the requirements of subsections 6.7.1 through 6.7.3, leak detection solution may be used to verify the absence of vapor leaks through the Phase I vapor poppet on two-point Phase I systems. This alternative leak check is valid only for two-point Phase I systems in which tanks are manifolded. The manifold may be at the vent pipes. Pressurize the system to two (2) inches $H_2O$ and use the leak detection solution to verify a zero leak (absence of bubbles) condition at one of the vapor poppets on the Phase I system.

**6.8** All pressure measuring device(s) shall be bench calibrated using either a reference gauge or incline manometer. Calibration shall be performed at 20, 50, and 80 percent of full scale. Accuracy shall be within two percent at each of these calibration points. Calibrations shall be conducted on a frequency not to exceed 90 days.

**6.9** Use the flowmeter to determine the nitrogen regulator delivery pressures which correspond to nitrogen flowrates of 1.0 and 5.0 CFM. These pressures define the allowable range of delivery pressures acceptable for this test procedure. Also record which regulator delivery pressure setting, and the corresponding nitrogen flowrate that will be used during the test. As an alternative, the flowmeter may be connected, in-line between the nitrogen supply regulator and Vapor Coupler Test Assembly, during the test.

**6.10** Use Equation 9.2 to calculate the approximate time required to pressurize the system ullage to the initial starting pressure of two (2.0) inches $H_2O$. This will allow the tester to minimize the quantity of nitrogen introduced into those systems which cannot comply with the static leak standards.

**6.11** Attach the Vapor Coupler Test assembly to the Phase I poppet or the "T" connector assembly to the Phase II vapor riser. Read the initial pressure of the storage tank and underground piping. If the initial pressure is greater than 0.5 inches $H_2O$, carefully bleed off the pressure, in accordance with all applicable safety procedures, in the storage tank and underground piping to less than 0.5 inches $H_2O$ column.

## 7. TESTING

**7.1** Open the nitrogen gas supply valve and set the regulator delivery pressure within the allowable range determined in Section 6.9, and start the stopwatch. Pressurize the vapor system (or subsystem for individual vapor return line systems) to **at least 2.2 inches $H_2O$** initial pressure. It is critical to maintain the nitrogen flow until the pressure stabilizes, indicating temperature and vapor pressure stabilization in the tanks. Check the test equipment using leak detecting solution or a combustible gas detector to verify that all test equipment is leak tight.

**7.1.1** If the time required to achieve the initial pressure of two (2.00) inches $H_2O$ exceeds twice the time derived from Equation 9.2, stop the test and use a liquid leak detector, or a combustible gas detector, to find the leak(s) in the system. Failure to achieve the initial starting pressure within twice the time derived from Equation 9.2 demonstrates the inability of the system to meet the performance criteria. Repair or replace the faulty component(s) and restart the test pursuant to Section 7.1.

**7.2** Close and disconnect the nitrogen supply. Start the stopwatch when the pressure has decreased to the initial starting pressure of two (2.0) inches $H_2O$.

**7.3** At one-minute intervals during the test, record the system pressure. After five minutes, record the final system pressure. See Table 3-I (or Equation 9.1) to determine the acceptability of the final system static pressure results. For intermediate values of ullage in Tables 3-I, linear interpolation may be employed.

**7.4** If the system failed to meet the criteria set forth in Table 3-I (or Equation 9-2), repressurize the system and check all accessible vapor connections using leak detector solution or a combustible gas detector. If vapor leaks in the system are encountered, repair or replace the defective component and repeat the test. Potential sources of leaks include nozzle check valves, pressure/vacuum relief

valves, containment box drain valve assemblies, and plumbing connections at the risers.

**7.5** After the remaining system pressure has been relieved, remove the "T" connector assembly and reconnect the vapor recovery hose, if applicable.

**7.6** If the vapor recovery system utilizes individual vapor return lines, repeat the leak test for each gasoline grade. Avoid leaving any vapor return line open longer than is necessary to install or remove the "T" connector assembly.

**7.7** **If the containment box has a cover-actuated drain valve, repeat the test with the cover in place. In these cases clearly specify, on Form 3-1, which results represent the pressure integrity with and without the cover in place**.

## 8. POST-TEST PROCEDURES

**8.1** Use Table 3-I, or Equation 9.1 to determine the compliance status of the facility by comparing the final five-minute pressure with the minimum allowable final pressure.

## 9. CALCULATIONS

**9.1** The minimum allowable five-minute final pressure, with an initial pressure of two (2.0) inches $H_2O$, shall be calculated as follows:

[Equation 9-1]

$$P_f = 2e^{\frac{-500.887}{V}} \quad \text{if N = 1-6}$$

$$P_f = 2e^{\frac{-531.614}{V}} \quad \text{if N = 7-12}$$

$$P_f = 2e^{\frac{-562.455}{V}} \quad \text{if N = 13-18}$$

$$P_f = 2e^{\frac{-593.412}{V}} \quad \text{if N = 19-24}$$

$$P_f = 2e^{\frac{-624.483}{V}} \quad \text{if N > 24}$$

Where:

N = The number of affected nozzles. For manifolded systems, N equals the total number of nozzles. For dedicated plumbing configurations, N equals the number of nozzles serviced by the tank being tested.

V = The total ullage affected by the test, gallons

$P_f$ = The minimum allowable five-minute final pressure, inches $H_2O$

e = A dimensionless constant approximately equal to 2.718

2 = The initial starting pressure, inches $H_2O$

**9.2** The minimum time required to pressure the system ullage from zero (0) to two (2.0) inches $H_2O$ gauge pressure shall be calculated as follows:

$$t_2 = \frac{V}{[1522]\,F} \qquad \text{[Equation 9-2]}$$

Where:

$t_2$ = The minimum time to pressurize the ullage to two inches $H_2O$, minutes

V = The total ullage affected by the test, gallons

F = The nitrogen flowrate into the system, CFM

1522 = The conversion factor for pressure and gallons

**9.3** If the policy of the local district requires an allowable tolerance for testing error, the minimum allowable five-minute final pressure, including testing error, shall be calculated as follows:

$$P_{f-E} = 2 - \left[1 + \left(\frac{E}{100}\right)\right]\left[408.9 - \left(P_f + 406.9\right)\right] \qquad \text{[Equation 9-3]}$$

Where:

$P_{f\text{-}E}$ = The minimum allowable five-minute final pressure including allowable testing error, inches $H_2O$

E = The allowable testing error, percent

$P_f$ = The minimum allowable five-minute final pressure calculated in Equations 9-1 or 9-2, inches $H_2O$

2 = The initial starting pressure, inches $H_2O$

408.9 = Atmospheric pressure plus the initial starting pressure, inches $H_2O$

406.9 = Atmospheric pressure, inches $H_2O$

## 10. REPORTING

**10.1** The calculated ullage and system pressures for each five-minute vapor recovery system test shall be reported as shown in Form 3-1. Be sure to include the Phase I system type (two-point or coaxial), the Phase II system type, whether the system is manifolded, and the one-minute pressures during the test.